Ecosystem services in urban water investment economics

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Research Question

- Water agencies and utilities obligated to consider broad impacts of infrastructure investments

- Broad impact accounting widely discussed, few impacts considered in practice

- Comprehensive enumeration of impacts likely to broaden the scope of impacts quantified

- Can ES and IWRM concepts facilitate comprehensive systematic enumeration of impacts?

Case Study Context

•State and federal government commissioned stormwater harvest projects in Adelaide

•To enhance supply reliability, control flooding, and reduce coastal pollution

•Stormwater as a substitute for River Murray and/or desalination

Two-stage Methodological Framework

- Synthesized 23 recent urban water investment studies for ES impacts
- Organising potential impacts of investments using ES and IWRM typology
- The ES framework

Cultural services

- Conservation ethic

Provisioning services

- Fish production values
- Recreation
- Amenity Space
- Coastal/Estuarine Amenity
- Freshwater provision

Regulation services

- Water quality
- Flood mitigation
- Erosion control
- Climate and air quality regulation

Supporting services

- Habitat maintenance
- Nutrient and soil cycling

Water supply investments	Water cycle stage					
	Extraction	**Storage**	**Conveyance**	**Treatment**	**Use**	**Disposal**
Surface water	*Provision freshwater, food and fibre and, fish production*	*Flood & erosion regulation, recreational amenity, habitat support, support for cultural spiritual values*	*Climate and air quality regulation, habitat support, aesthetics- disamenity value*	*Water quality regulation, estuarine amenity, & habitat support*	*Amenity space, cultural & education, and research values, provision food and fibre production*	*Provision fish production, coastal amenity, & habitat support*
Stormwater	*flood regulation*	*Flood & erosion regulation, recreational amenity, habitat support*	*Climate and air quality regulation, habitat support, aesthetics- (dis) amenity value*	*Water quality regulation, estuarine amenity, & habitat support, provision fish production, Climate and air quality regulation, support nutrient and soil cycling*	*Amenity space, cultural & education, and research values, Provision freshwater,*	*Provision fish production, coastal amenity, & habitat support, Erosion regulation, support nutrient and soil cycling*
Wastewater	*Water quality regulation, provision freshwater , Climate and air quality regulation*	*recreational amenity, habitat support*	*Climate and air quality regulation, habitat support, aesthetics- disamenity value*	*Water quality regulation, estuarine amenity, & habitat support*	*Amenity space, cultural & education, and research values, provision food and fibre production, cultural disbenefits, habitat support*	*Water quality regulation, Provision fish production, coastal amenity, & habitat support*

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Thinking about investments

- Comparing new supply options with shortfalls (e.g. Adelaide prior to desalination plant)

- Possible scenarios for source substitution

	Stormwater	Desalination	River Murray
Capital (A$/kL)	(1.12)	(2.00)	
O&M (A$/kL)	0.28	0.80	0.20
Median salinity (Mg/L)	125	160	400
GHG emissions (X 10^3 Tonnes/yr)	13.4	30.1	12.0

Results (A$/kL)

Ecosystem service impact	Estimate	Valuation technique
Provisioning services		
Freshwater provision	-0.08 - 0.52	Avoided cost
Recreational amenity parks	0.02	Hedonic pricing
Coastal recreational amenity	1.03	Replacement cost
Regulation services		
Water quality salinity	0.02	Avoided damage
Climate regulation	-0.00 - 0.05	LCA
Supporting services		
Habitat maintenance	0.05	Survey
Total	**1.06 – 1.97**	

Results - Continued

- O&M cost stormwater harvesting - A$0.28/kL
- Net benefit including ES impacts – between A$1.06/kL & A$1.97/kL
- Not accounting for ES impacts would underestimate the net benefit by between A$0.78/kL & A$1.69/kL

Discussion & Conclusions

- Omitted ES values would only increase the estimate for net benefit
- Magnitude of ES values large compared to capital, O&M – may change investment decisions in many UW contexts
- ES typology facilitates systematic quantification of broader environmental impacts and tradeoffs
- Needs to be augmented with IWRM concept to be comprehensive

Limitations

•Replacement cost techniques provide lower bound estimate and can underestimate benefit value

•Isolating the contribution of ES to welfare can be a challenging task

•Valuing ES impacts in isolation and adding them up can result in double counting errors